the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:30 or 42.

57. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:13, 14, 15, 16, 21, 22, 44, and 48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a solution comprising 0.5x SSC.

58. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 124 to 451 of SEQ ID NO:1, amino acids 135 to 462 of SEQ ID NO:2, amino acids 109 to 436 of SEQ ID NO:3, amino acids 23 to 351 of SEQ ID NO:4, amino acids 134 to 461 of SEQ ID NO:19, amino acids 109 to 436 of SEQ ID NO:20, amino acids 288 to 615 of SEQ ID NO:43, and amino acids 238 to 465 of SEQ ID NO:47.

59. The nucleic acid of claim 58, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

60. The isolated nucleic acid of claim 56, 57, or 58, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:19, SEQ ID NO:20, SEQ ID NO:43, and SEQ ID NO:47.

61. The isolated nucleic acid of claim 56, 57, or 58, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:13, SEQ ID NO:14, SEQ ID NO:15, SEQ ID NO:16, SEQ ID NO:21, SEQ ID NO:22, SEQ ID NO:44, and SEQ ID NO:48.

62. The isolated nucleic acid of claim 56, 57, or 58, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

63. An expression vector comprising a nucleic acid of claim 56, 57, or 58.

64. A host cell transfected with the vector of claim 63.

B' Cont

65. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 64 under conditions permitting expression of said nucleic acid encoding said channel protein.

66. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:13, SEQ ID NO:14, SEQ ID NO:15, SEQ ID NO:16, SEQ ID NO:21, SEQ ID NO:22, SEQ ID NO:44, and SEQ ID NO:48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl

and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

67. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:1 or 4.

68. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

B1 Cont

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:13 and 14, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a solution comprising 0.5x SSC.

69. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 124 to 451 of SEQ ID NO:1 and amino acids 23 to 351 of SEQ ID NO:4.

70. The nucleic acid of claim 69, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

71. The isolated nucleic acid of claim 67, 68, or 69, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:1 and SEQ ID NO:4.

72. The isolated nucleic acid of claim 67, 68, or 69, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:13 and SEQ ID NO:14.

B1 Cont.

73. The isolated nucleic acid of claim 67, 68, or 69, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

74. An expression vector comprising a nucleic acid of claim 67, 68, or 69.

75. A host cell transfected with the vector of claim 74.

76. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 75 under conditions permitting expression of said nucleic acid encoding said channel protein.

77. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:13 and SEQ ID NO:14, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

78. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:2 or 19.

B1 cont.

79. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:15 and 21, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a

solution comprising 0.5x SSC.

80. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 135 to 462 of SEQ ID NO:2 and amino acids 134 to 461 of SEQ ID NO:19.

81. The nucleic acid of claim 80, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

82. The isolated nucleic acid of claim 78, 79, or 80, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:2 and SEQ ID NO:19.

83. The isolated nucleic acid of claim 78, 79, or 80, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:15 and SEQ ID NO:21.

84. The isolated nucleic acid of claim 78, 79, or 80, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

85. An expression vector comprising a nucleic acid of claim 78, 79, or 80.

86. A host cell transfected with the vector of claim 85.

87. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 86 under conditions permitting expression of said nucleic acid encoding said channel protein.

88. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:15 and SEQ ID NO:21, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

89. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:3, 20, 43, or 47.

B1 Cont.

90. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in

the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:16, 22, 44 and 48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a solution comprising 0.5x SSC.

91. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 109 to 436 of SEQ ID NO:3, amino acids 109 to 436 of SEQ ID NO:20, amino acids 288 to 615 of SEQ ID NO:43, and amino acids 238 to 465 of SEQ ID NO:47.

B1 Cont

92. The nucleic acid of claim 91, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

93. The isolated nucleic acid of claim 89, 90, or 91, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:3, SEQ ID NO:20, SEQ ID NO:43 and SEQ ID NO:47.

94. The isolated nucleic acid of claim 89, 90, or 91, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:16, SEQ ID NO:22, SEQ ID NO:44 and SEQ ID NO:48.

95. The isolated nucleic acid of claim 89, 90, or 91, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

96. An expression vector comprising a nucleic acid of claim 89, 90, or 91.

97. A host cell transfected with the vector of claim 96.

98. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 97 under conditions permitting expression of said nucleic acid encoding said channel protein.

99. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:16, SEQ ID NO:22, SEQ ID NO:44 and SEQ ID NO:48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

B1 cont

Add C1

REMARKS

The invention

In one aspect, the present application provides, for the first time, identification of a family of calcium-activated potassium channels. This family is called the "SK" family, for small conductance potassium channels. This family of channels is highly conserved (about